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Original article

The impact of continuity of care on emergency room use in a health care system without referral management: an instrumental variable approach

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ABSTRACT

Purpose: The purpose of the study was to determine whether continuity of care (COC) is beneficial in national health care systems without referral management by controlling for endogeneity of COC.
Methods: We used National Health Insurance (Taiwan) claims data from 2008, encompassing approximately 23 million people, to determine whether COC is associated with reduced emergency room (ER) use by hypertension and diabetic patients in 2009. We used an instrumental variable approach to account for endogeneity associated with patients' COC levels.
Results: After controlling for endogeneity, the marginal effect of COC on ER use probability when the COC score increased from 0 to 1 was 7.6% ($P < .001$) and 14.8% ($P < .001$) for hypertension and diabetic patients, respectively.
Conclusions: We determined that COC is more effective for reducing ER use than are models that assume that COC is exogenous. It has been argued that in many countries, health care systems without referral management encourage physician shopping and hinder physician-patient communication. However, there are benefits to disease-specific COC. Because current estimations have failed to take endogeneity biases into account, COC is more effective than is currently assumed.

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Introduction

Continuity of care (COC) has garnered attention over the past decade. COC is normally defined as a relationship between a health care provider and a patient who continues beyond the treatment of a particular disease episode [1]. Although studies have suggested a positive relationship between COC and patient outcomes [2–8], the effect of COC on patient outcomes under a health care system without referral management remains unclear because of methodological issues. The main arguments in favor of COC are that it encourages strong physician-patient affiliation, trust, and communication [9], and allows physicians to gain a coherent sense of a patient's medical history and sustain a sense of clinical responsibility [10,11]. However, studies have also observed that COC does not positively influence patient outcomes. One study demonstrated that continual care by a single physician is not associated with greater control of cardiovascular risk factors [12]. Other studies have determined that provider continuity is not associated with medication compliance [13], patient complications, or patient satisfaction [14]. It has been argued that COC may not influence care outcomes in certain health care systems, such as systems where group practices prevail [15,16]. This variation in results could be attributed to the differences between health care systems and the endogenous nature of maintaining COC.

Two gaps remain in COC research. First, it is unclear whether the positive effects of COC on patient outcomes can be realized in a health system that lacks referral management; second, we are unaware of studies considering the possibility of COC being endogenous when estimating how COC affects patient outcomes. Previous studies have argued that COC is crucial in primary care settings [15,16]. However, in health care systems without formal primary physician arrangements, such as the Taiwanese system [2], patients choose physicians based on their disease symptoms, and physicians often use independent treatment decision-making processes specific to their specializations.

Taiwan's National Health Insurance (NHI) program, implemented in 1995, is a compulsory public health insurance for all

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Taiwanese citizens. More than 96% of hospitals and 92% of clinics in Taiwan are contracted with NHI [17]. NHI covers a wide range of services, including outpatient, inpatient, emergency room (ER), and dentistry. Patients are free to choose medical providers and specialists at any level without referrals. Health care systems like the Taiwanese system focus on specialist and hospital care instead of primary care in providing the public with integrated and accessible health care services [2]. Most outpatient and inpatient services are covered under NHI. In addition to Taiwan, other Asian countries, such as Japan and South Korea, also have health care systems without an arrangement for referrals [17].

Another issue that is often ignored by previous studies is that COC may be endogenous. A person who chooses to visit the same physician for care may be expressing health care—seeking behavior; thus, it is reasonable to assume that personal traits influence health care—seeking behavior. For example, studies have indicated that those with high education levels demonstrate poor continuity [18,19]. If we assume that highly educated people exhibit certain personal traits, for example, they are prone to practicing responsible health behaviors, then a pure correlation between COC and patient outcome may underestimate the positive effects of high COC. By contrast, it is possible that people maintaining COC relationships with their physicians care more about their health compared with those who do not maintain such relationships; hence, they exhibit positive health behavior. In this case, failing to control for endogeneity would overestimate how COC affects patient outcomes.

The study objective was to test whether COC prevents ER use in a health care system without referral management. We chose to study two diseases highly prevalent globally and in Taiwan: hypertension and type II diabetes. This study addressed the endogeneity of COC by using an instrumental variable (IV) approach. The proposed IV was the average continuity within a family of the same diseases. Family members tend to exhibit similar health care—seeking behavior, and numerous studies have shown that families share beliefs regarding health and behaviors related to illness [20–22]. However, family members' health care—seeking behavior do not directly affect whether a person visits the ER.

Data and methods

Data and study sample

We used Taiwan's NHI claims database, comprising approximately 23 million people. The NHI claims database contains all records of physician use covered by NHI. We tested whether COC in 2008 affected ER use in 2009 for hypertension and diabetic patients with a valid instrumented COC score. Analyzing the impact of COC in 1 year on health care use in a subsequent year is a common practice in the COC literature [8,23–25].

Measures

COC and the IVs

There are several measures of COC, and they are used to assess a variety of dimensions. Systematics review on different types of COC measures have been provided by previous studies [26,27]. The continuity of care index (COCI) has been widely used. The COCI is less affected by the number of visits than other measures of COC [2,17,28] and is more suitable for measuring the situation in Taiwan, where the lack of a referral system encourages physician shopping, hence increasing the number of visits. In addition, COCI has been used by many previous studies that also used claims data [29–31], including several studies from Taiwan [2,29,32]. Thus, the COCI was

used to measure COC in this study. For each person, COC was defined as follows [33]:

$$COC = \frac{\left(\sum_{i=1}^{p} n_i^2 - T\right)}{T(T-1)}$$

where T is the total number of outpatient visits; n_i is the number of visits to physician i; p is the total number of physicians. Each provider is identified with a unique identifier in our claims database. It is not possible to have multiple providers in a single encounter; if a patient visited two physicians within a same day, or the patient was referred to another physician by the first physician, the visits would be coded as two separate encounters in the database. The index ranged from 0 to 1, where 0 indicated "no continuity," and 1 indicated "perfect continuity." Only visits that were related to hypertension and/or diabetes were included. The diagnosis codes used to identify hypertension and diabetic patients were defined according to the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM). A hypertension visit was defined as a visit in which a diagnosis was provided according to diagnosis code ICD-9-CM 401–405, and a diabetes visit was defined as a visit in which a diagnosis was provided according to the diagnosis code ICD-9-CM 250.xx. People with less than three qualifying visits were excluded because COC scores are not meaningful for a low number of visits [7,29], and the index is less affected by care dispersion when excluding people with a low number of visits [8]. The two diseases were analyzed independently.

The IVs were the average hypertension- and diabetes-specific COC scores within families. People with hypertension and diabetes were identified using ICD-9-CM diagnosis codes. The NHI claims data enabled us to determine whether a person has family members by determining whether the person has or is a dependent. Because our database included all people in Taiwan in 2008, it was possible to identify related family members. A hypertension patient had a valid instrumented COC score for hypertension if he or she had at least one family member with hypertension within the same year (2008). The same method was applied to diabetic patients, and the two diseases were analyzed independently. In Taiwan, if a hypertension or diabetic patient and a family member both have jobs with government-managed wages, then they must be enrolled in the NHI as independents by law. Therefore, family members who were not enrolled in the system as dependents of a hypertension or diabetic patient or did not have dependents diagnosed with hypertension or diabetes were not included in our analysis. This method enabled us to identify partial family members instead of full family members.

Some discussion is necessary regarding the exogeneity of our IV. It could be argued that if family members have the same diseases, their unobserved traits or behaviors can be correlated with their COC scores and the probability of our outcome variable. We lack data to test; however, we argue that genetic effects play a crucial role regarding hypertension and diabetes [34]. Thus, individual health behavior is more correlated with the extent of disease control or the severity of a family member's disease than having the disease per se. It has also been argued that avoidable ER visits are affected by the regular health care—seeking behaviors of patients [29], rather than having the disease alone. Previous studies based on comprehensive survey data have used the behaviors or health statuses of family members as IVs for individual behavior or health status [34,35], indicating that shared family traits do not threaten the exogeneity of their instruments.

To determine COC scores within a person's family, the hypertension- and diabetes-specific COC scores of all family members